

FIG. 48

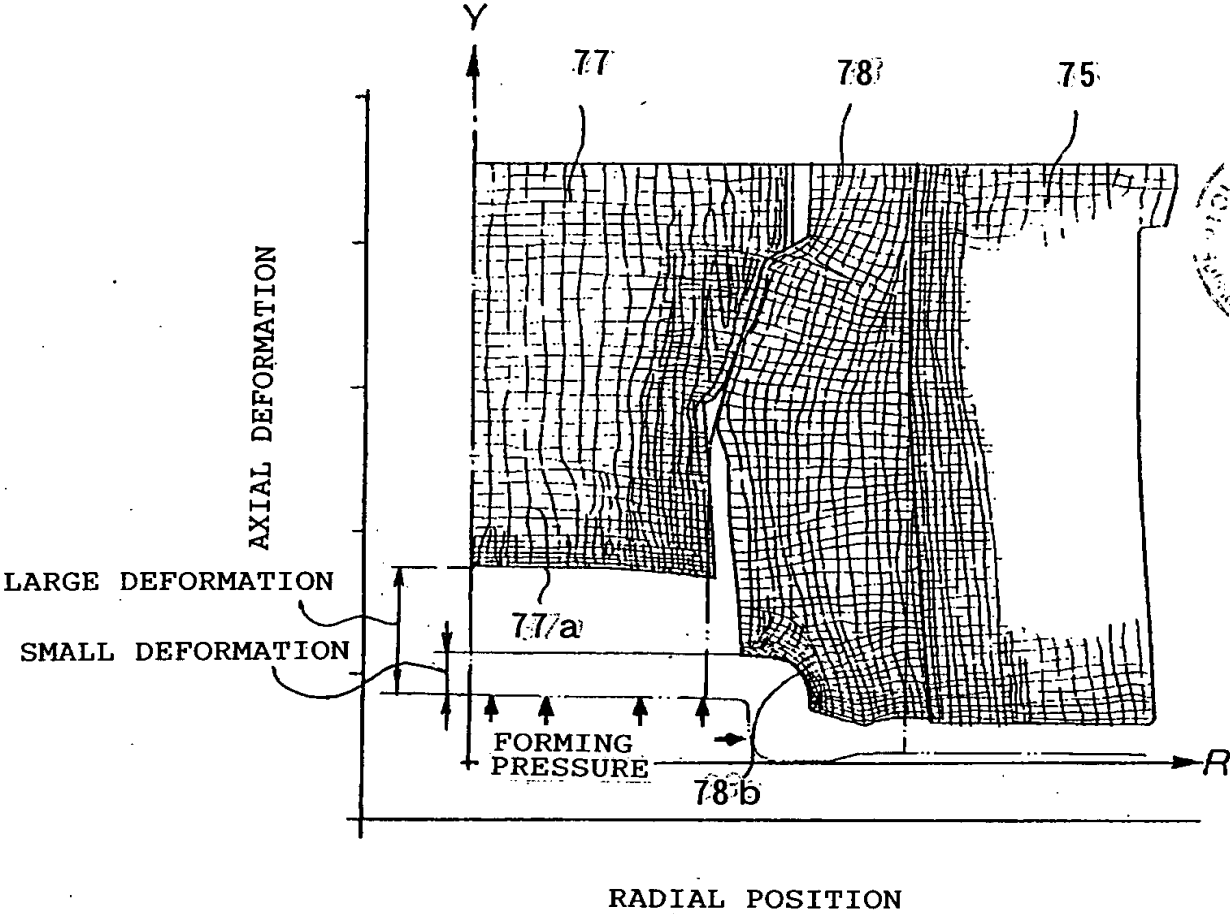


FIG. 46

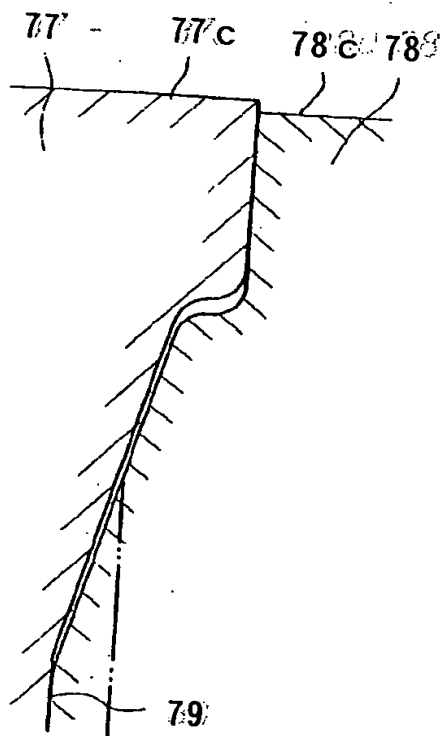


FIG. 47

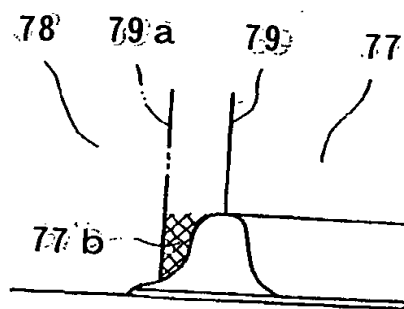


FIG. 44

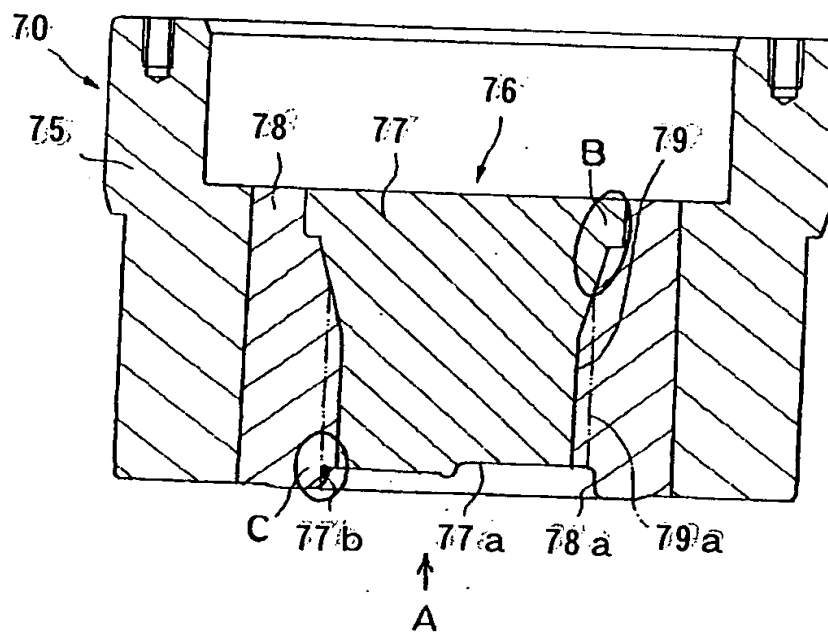


FIG. 45

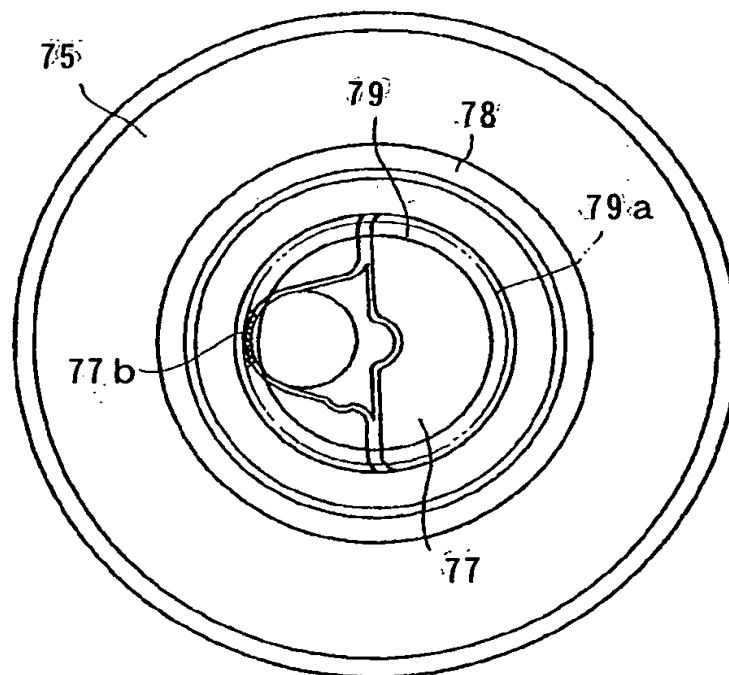


FIG. 43

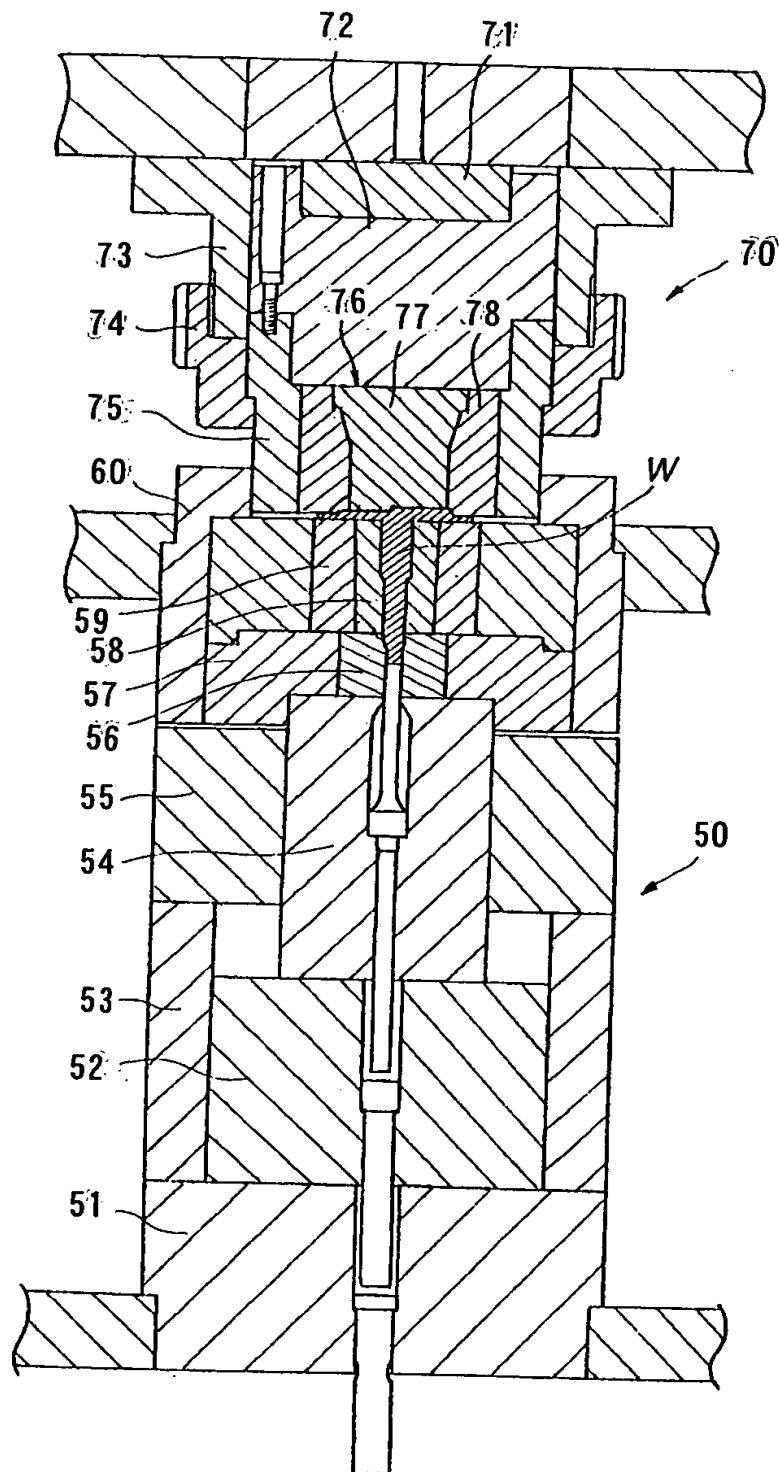
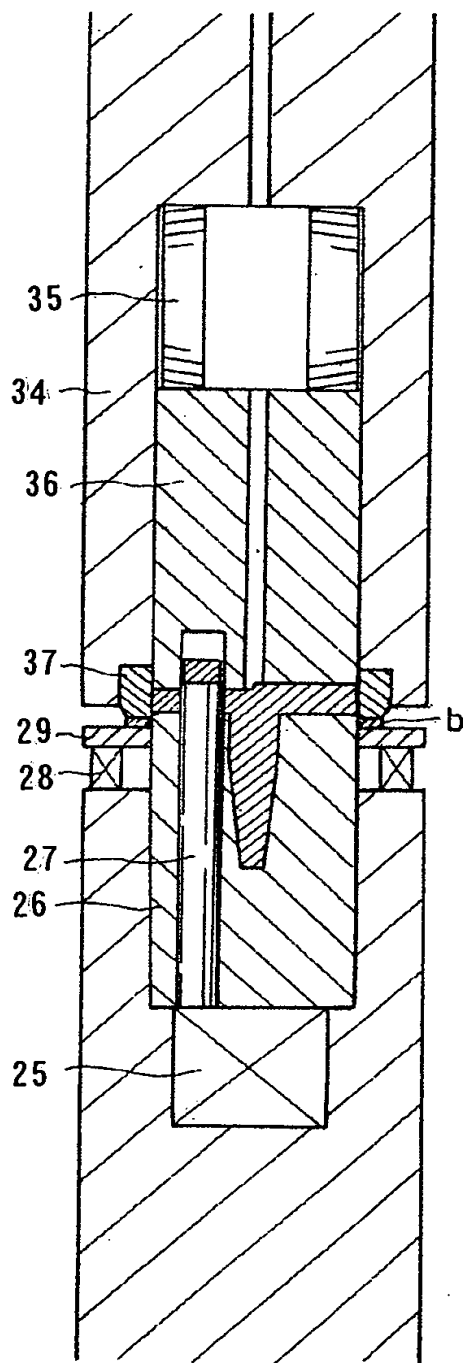
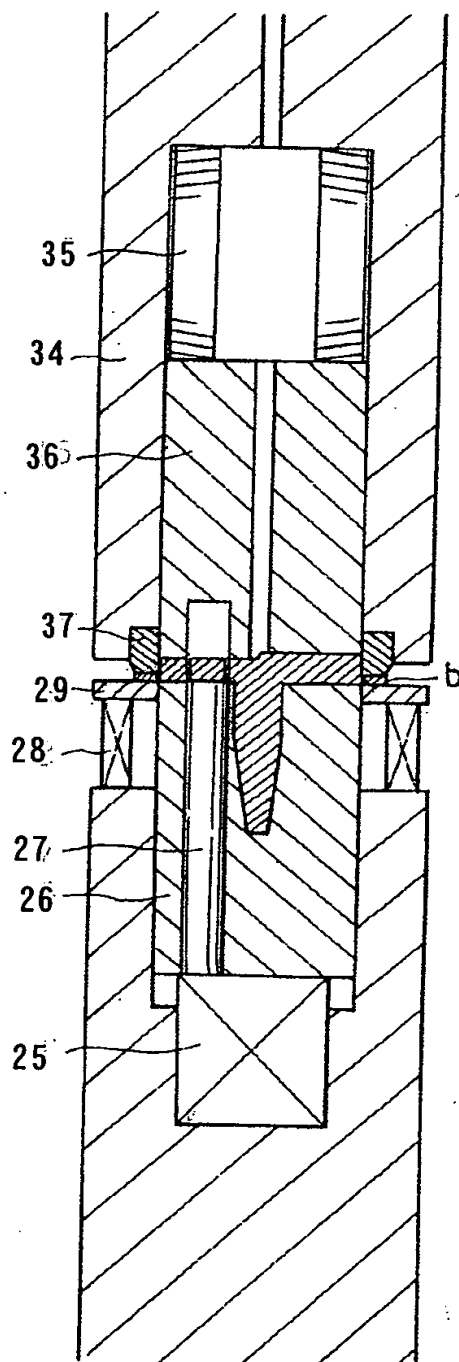


FIG. 42



(a)



(b)



FIG. 40

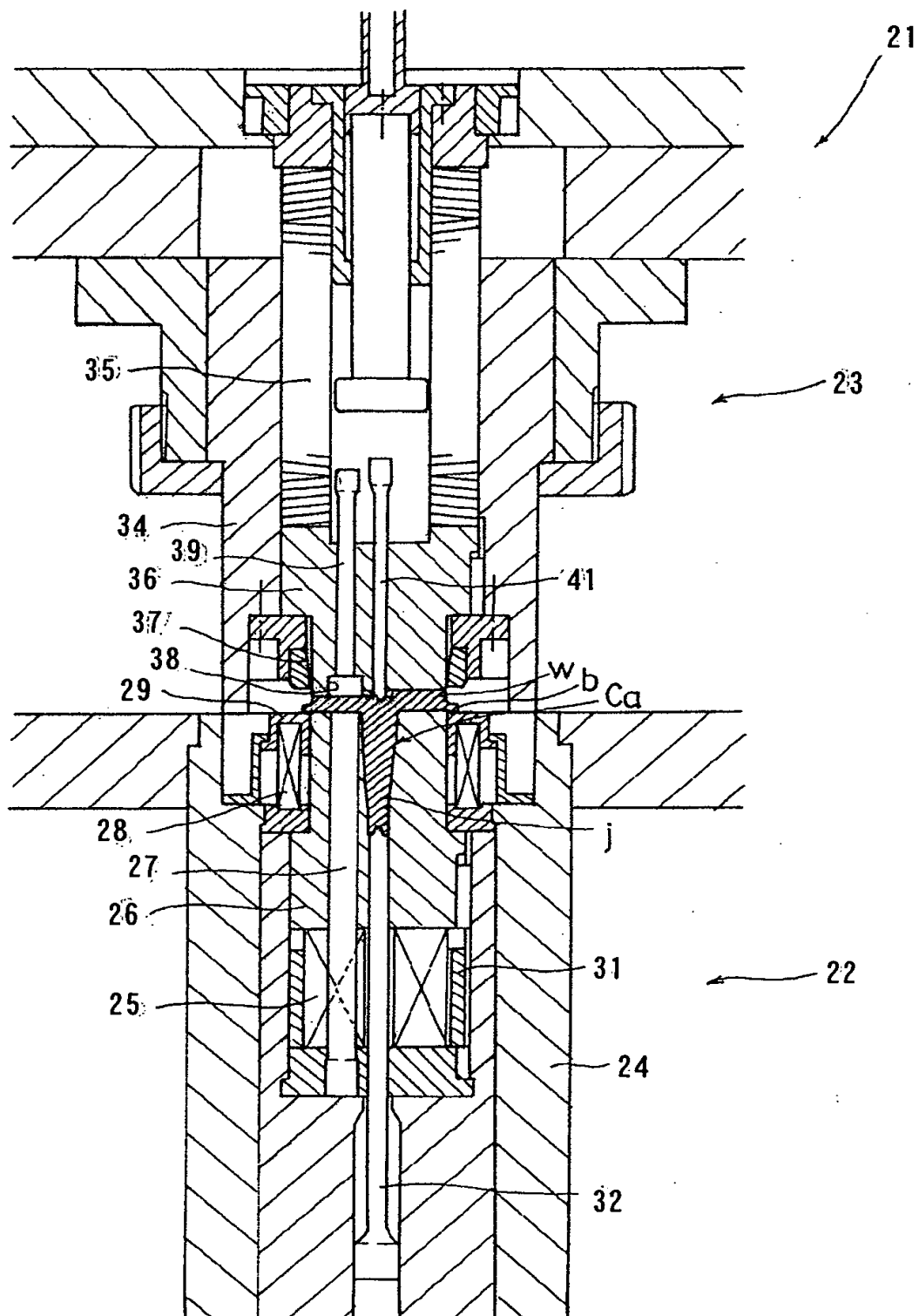


FIG. 39

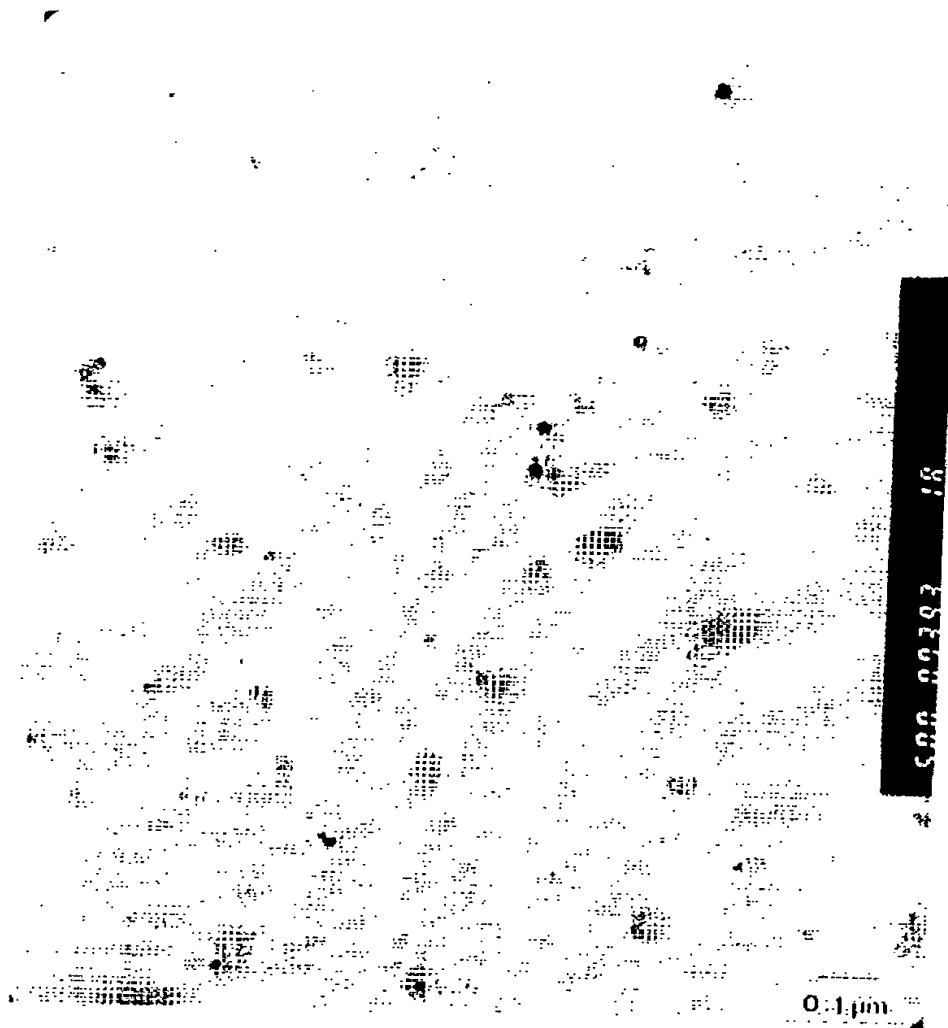




FIG. 38

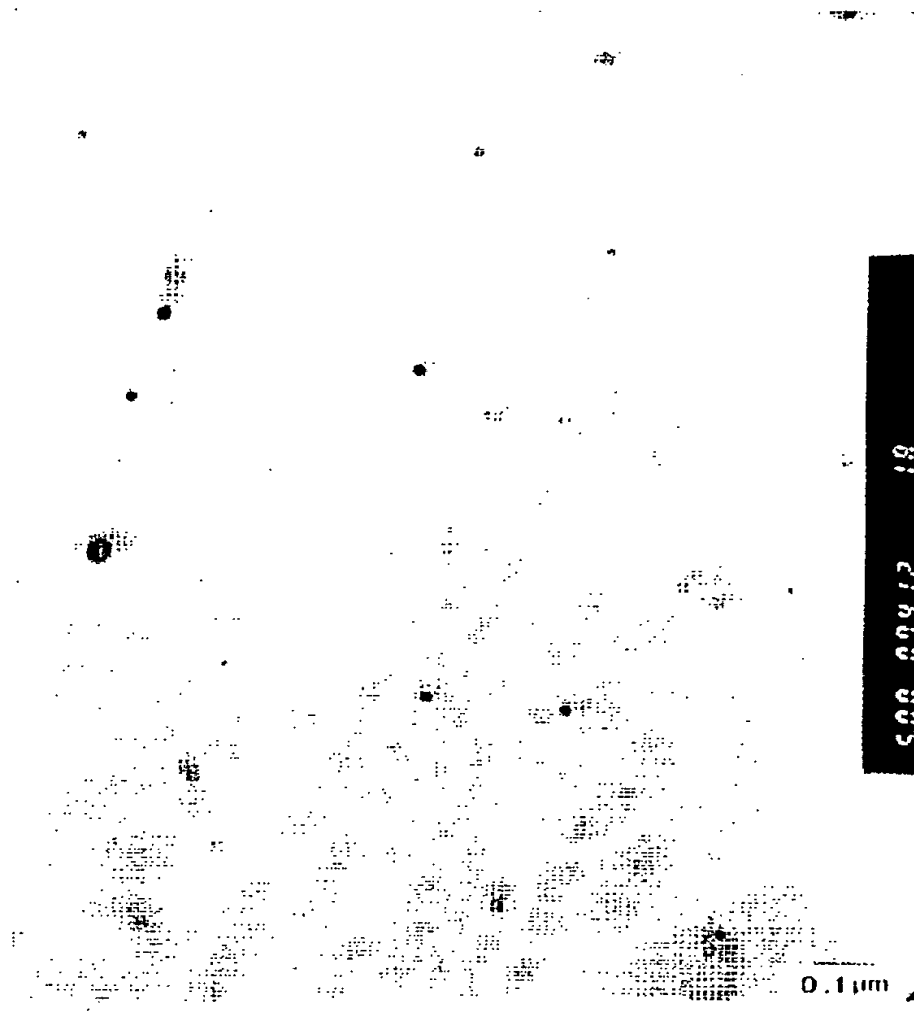
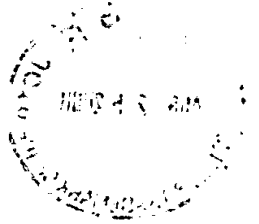
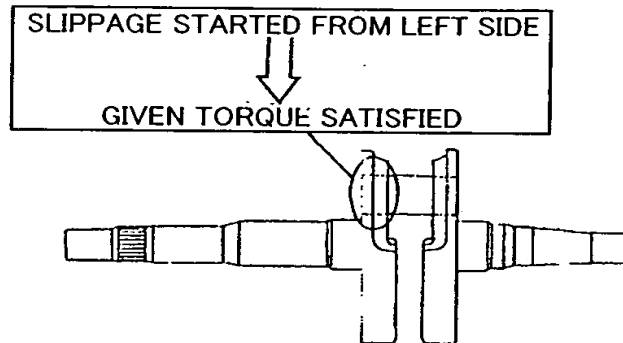


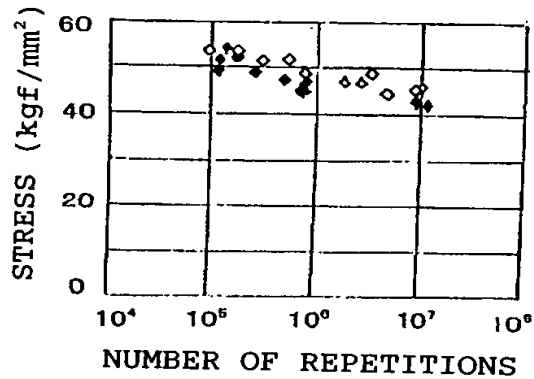
FIG. 37

SLIP TORQUE



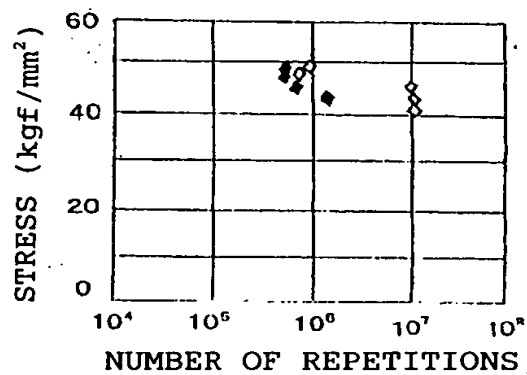
(a)

S - N CURVE (ROTATIONAL BENDING FATIGUE TEST)



(b)

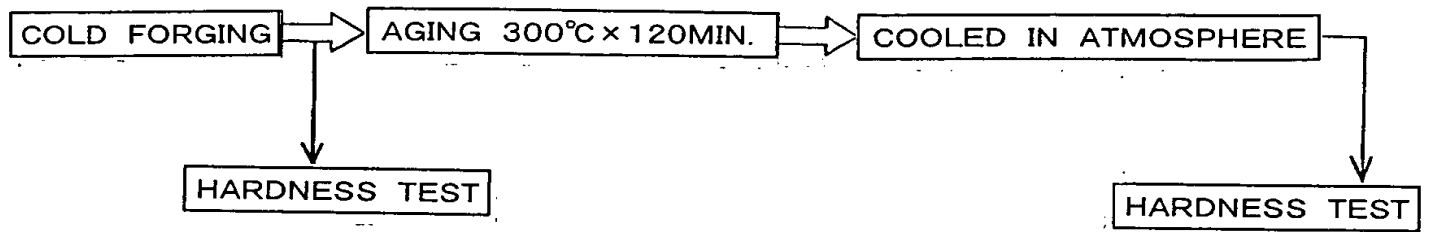
S - N CURVE (SOLID BENDING FATIGUE TEST)



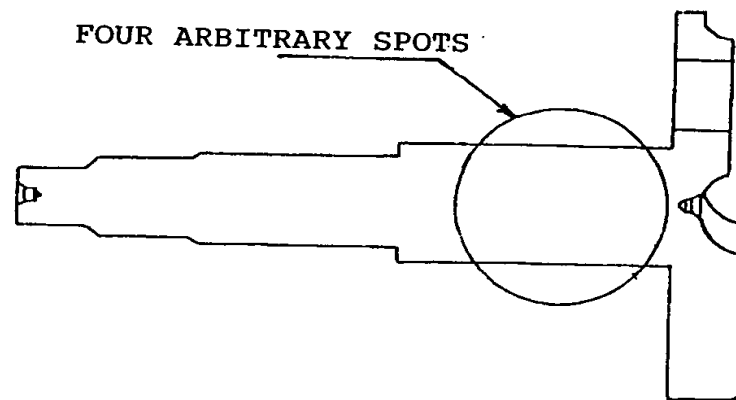
(c)



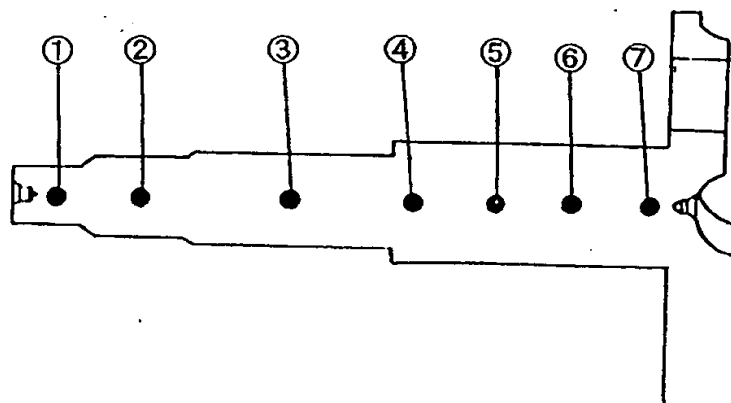
FIG. 36



(a)



(b)



(c)

FIG. 35

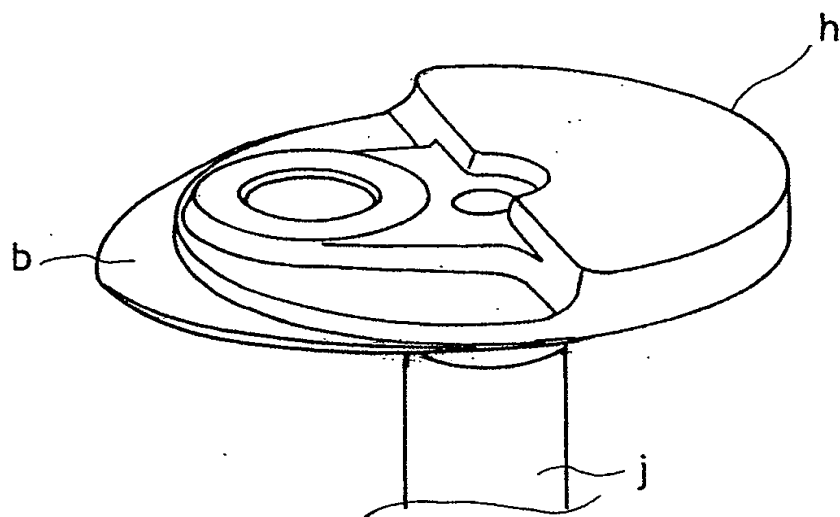
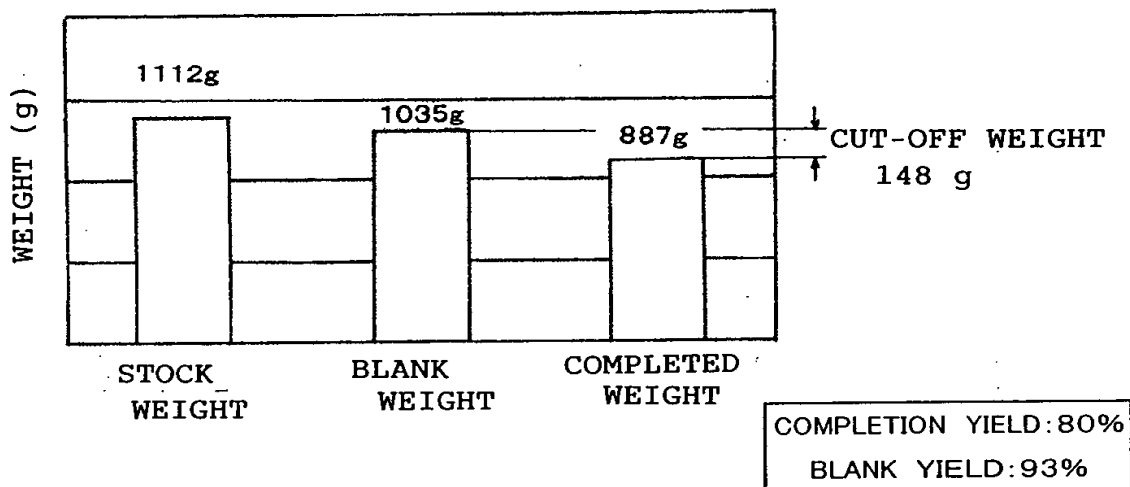


FIG. 34

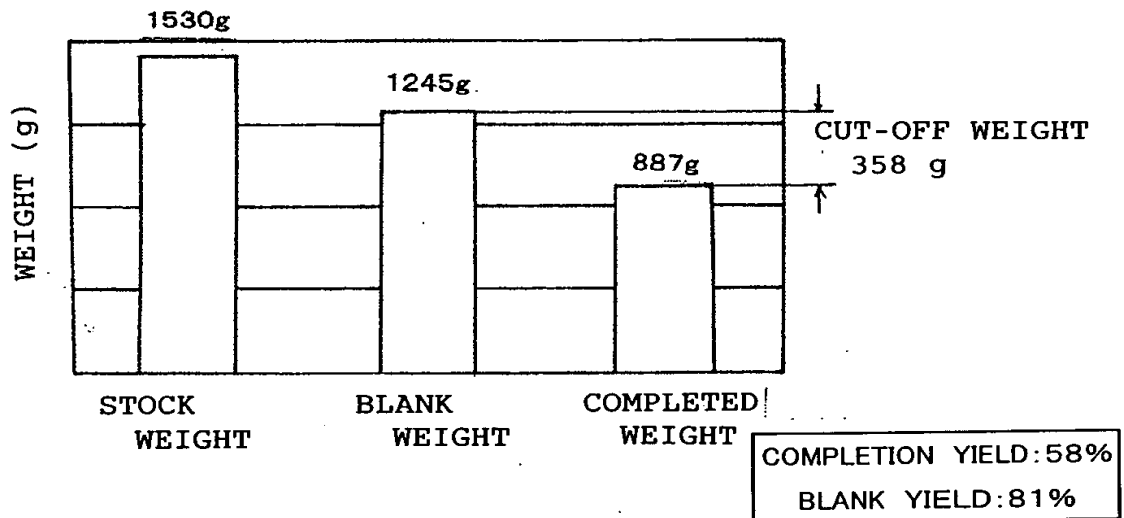


(INVENTIVE COLD-FORGING METHOD)



(a)

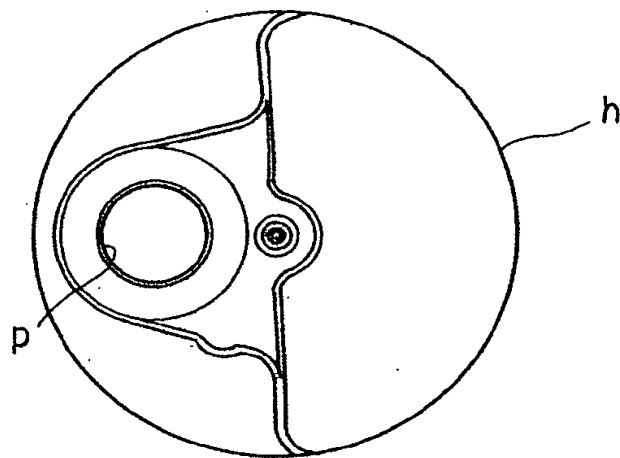
(CONVENTIONAL COLD-FORGING METHOD)



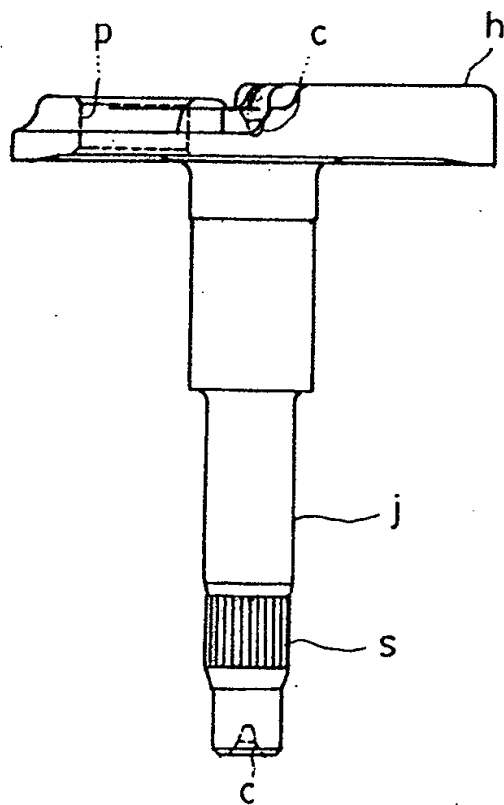
(b)

FIG. 33

OFFICE  
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U.S. PATENT  
AND  
TRADEMARK  
OFFICE

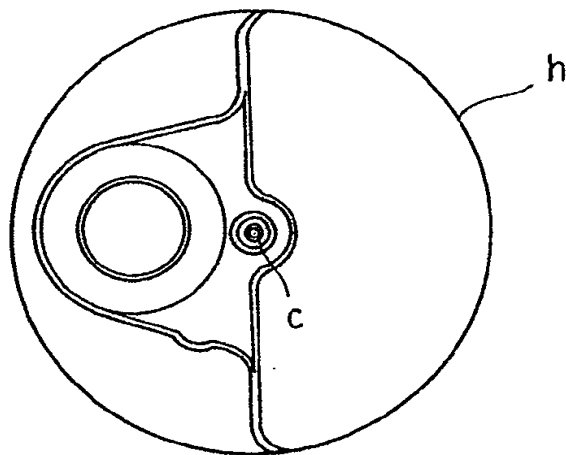


(a)

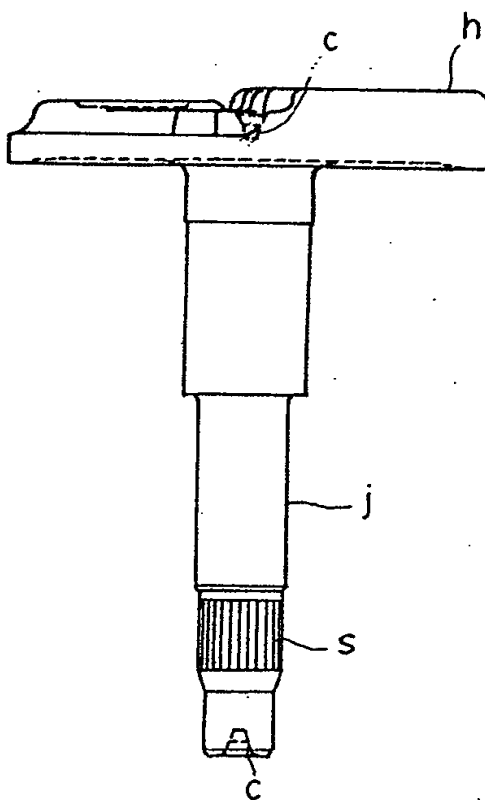


(b)

FIG. 32

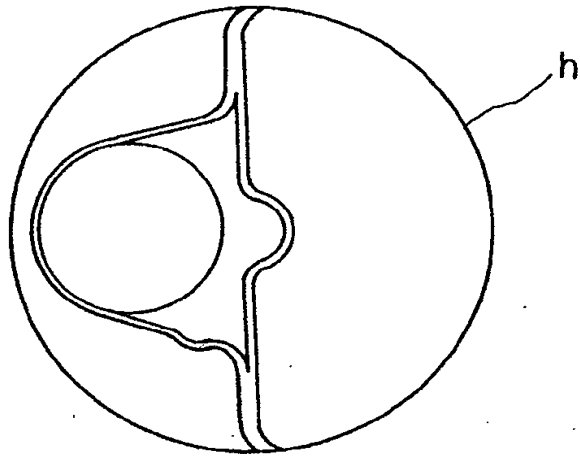


(a)

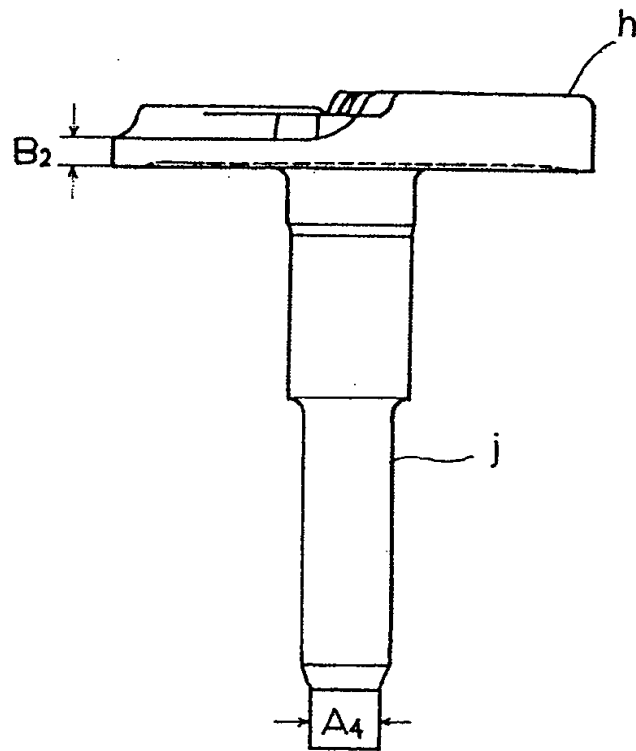


(b)

FIG. 31



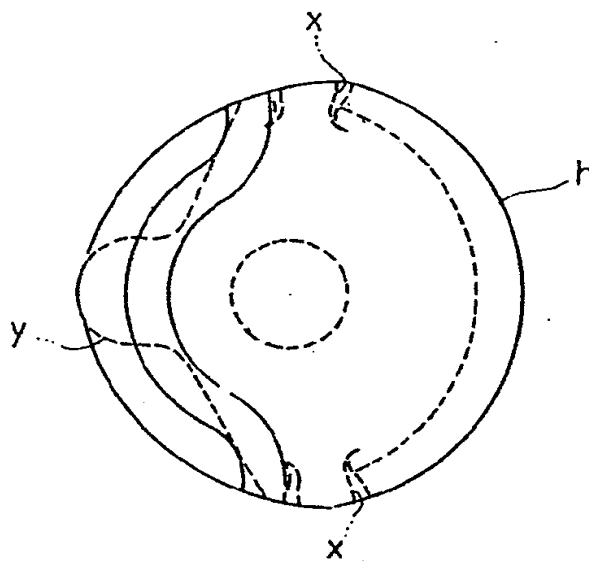
(a)



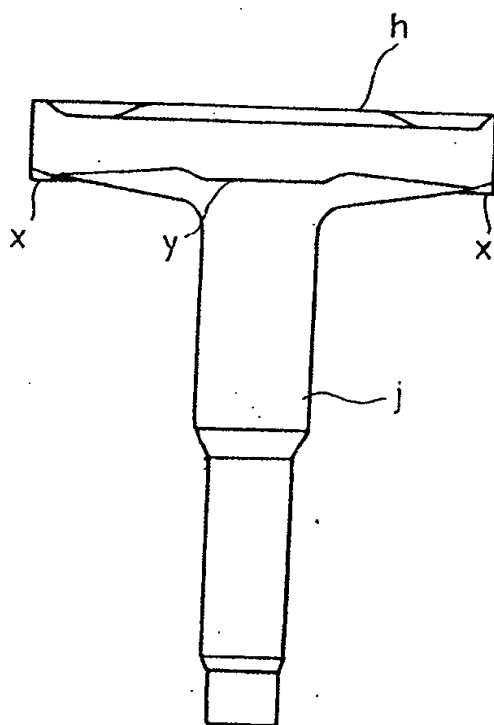
(b)



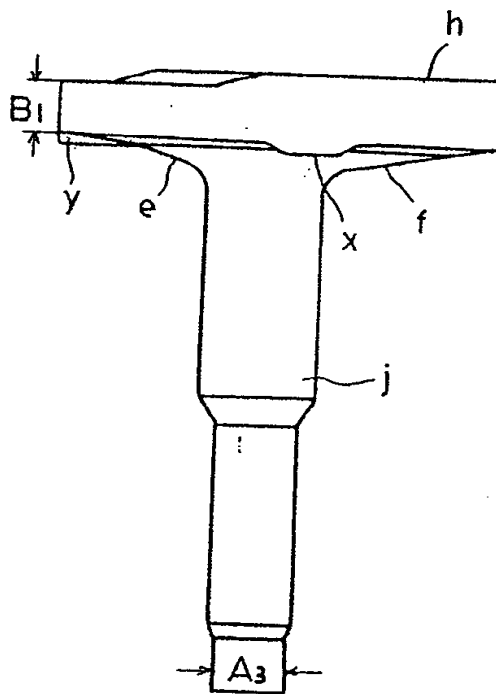
FIG. 30



(a)

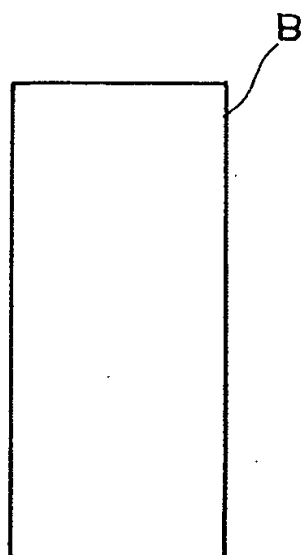


(b)

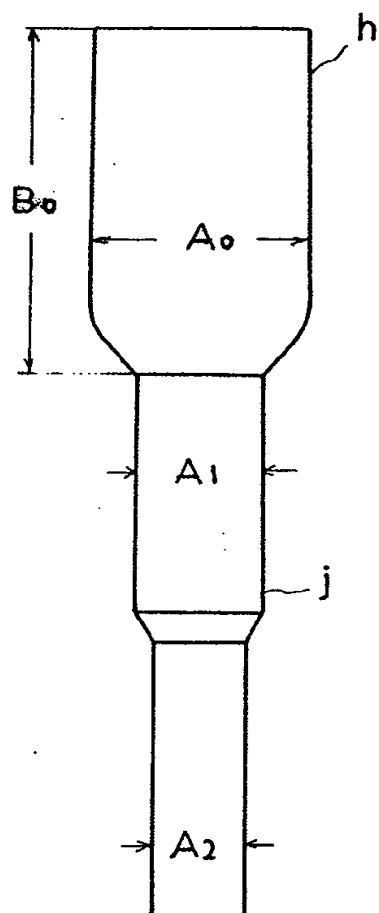


(c)

FIG. 29



(a)



(b)

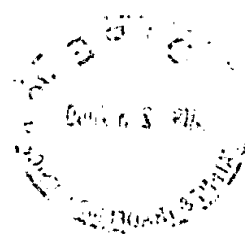


FIG. 27

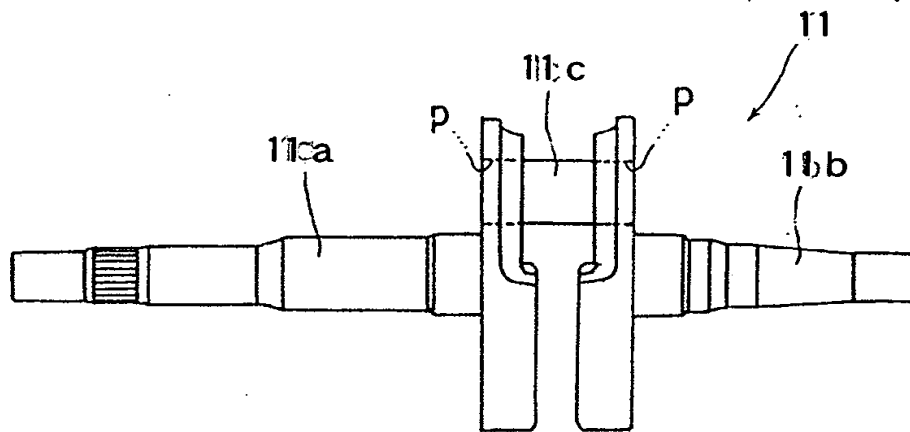
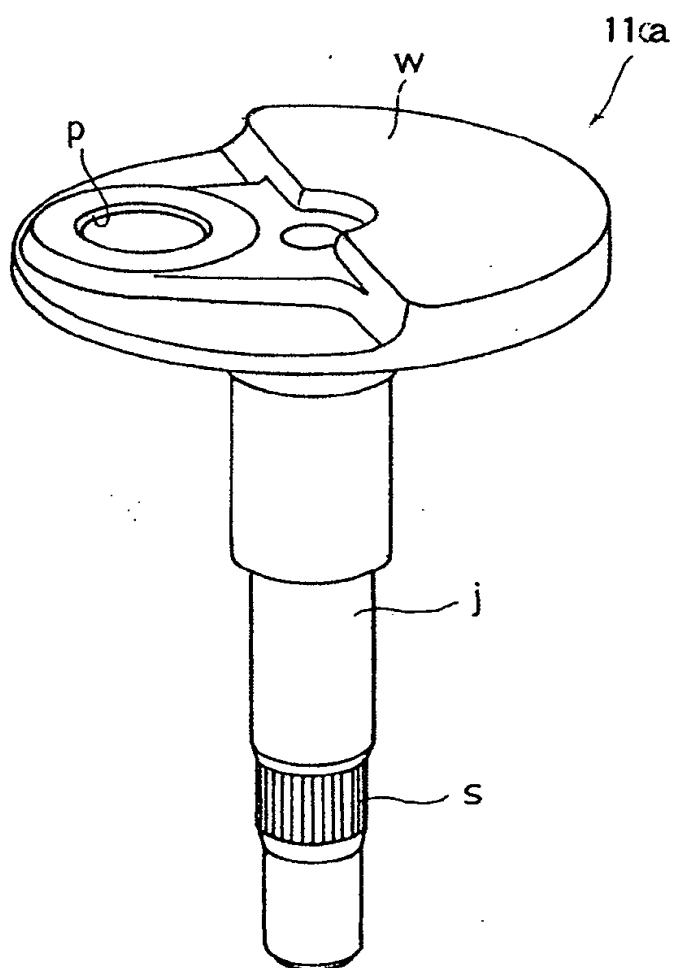


FIG. 28



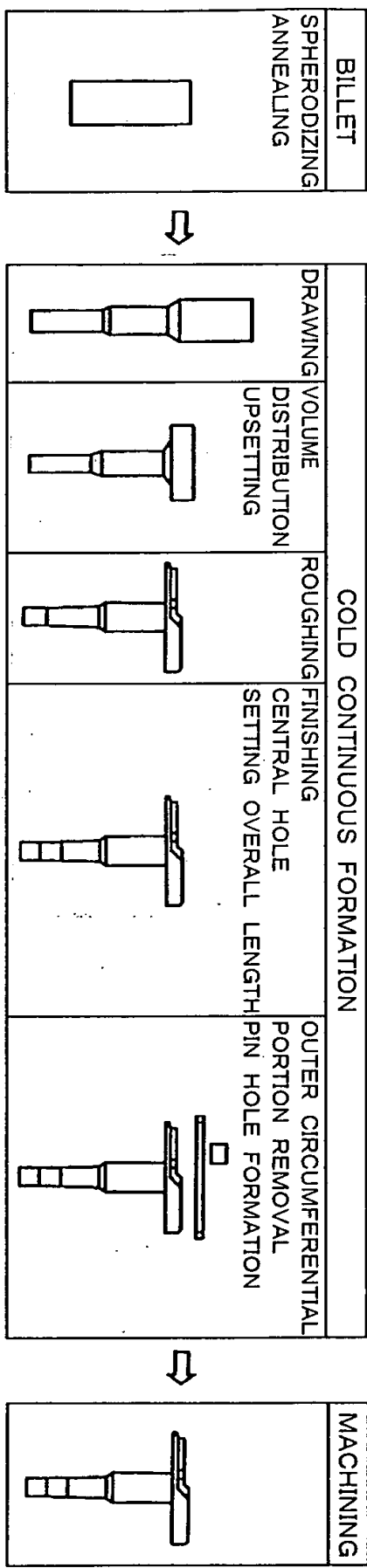


FIG. 26

FIG. 25

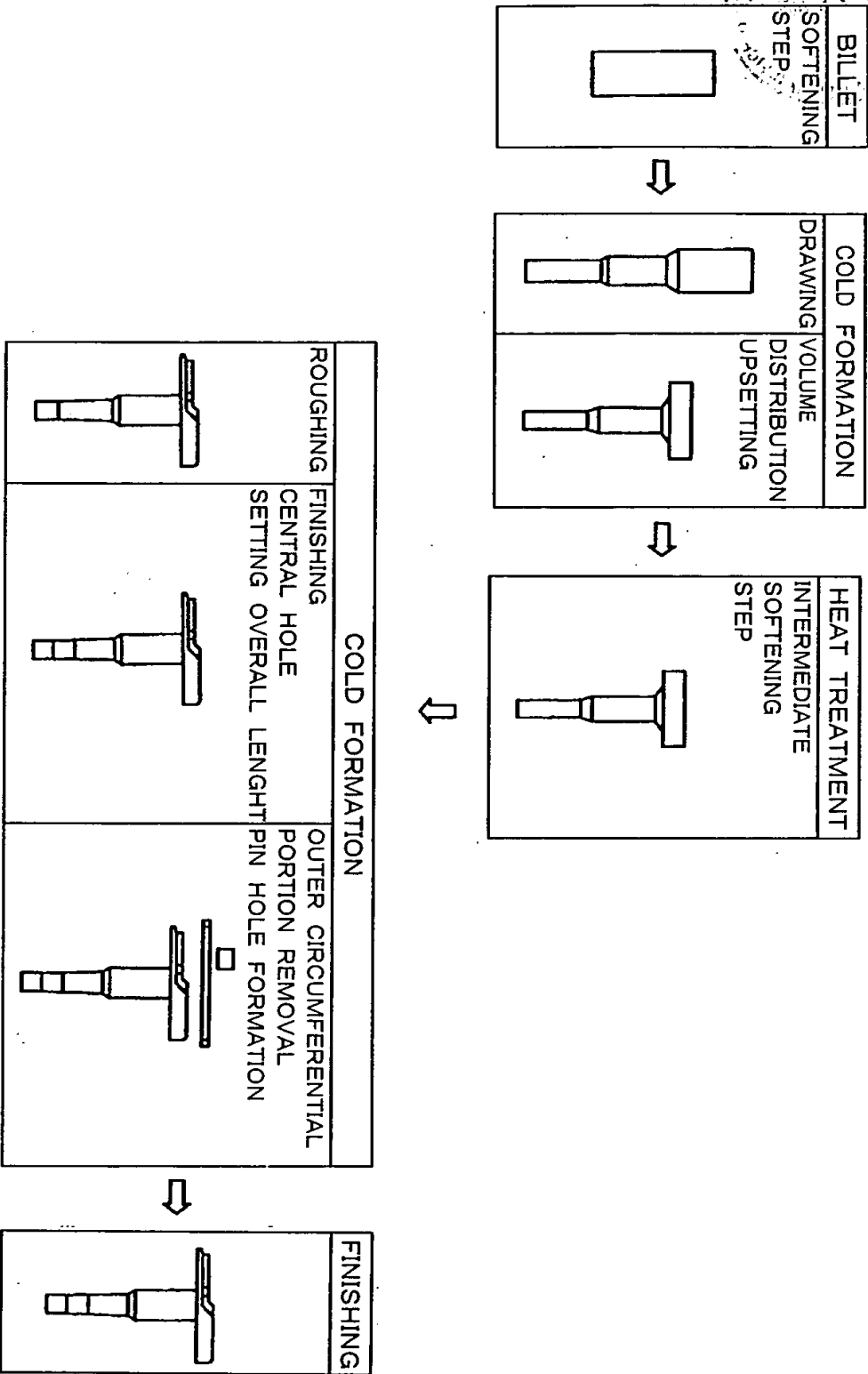


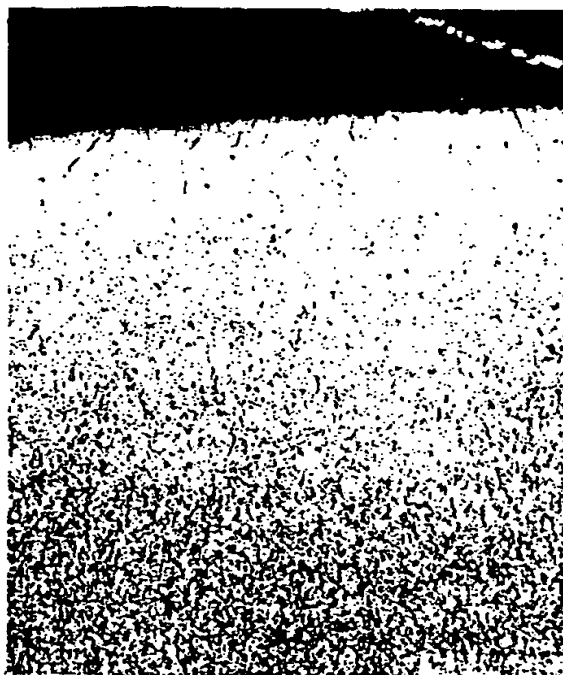
FIG. 24



AFTER SPHERODIZING ANNEALING PATTERN 2  
1/2 R PART  $\times$  400

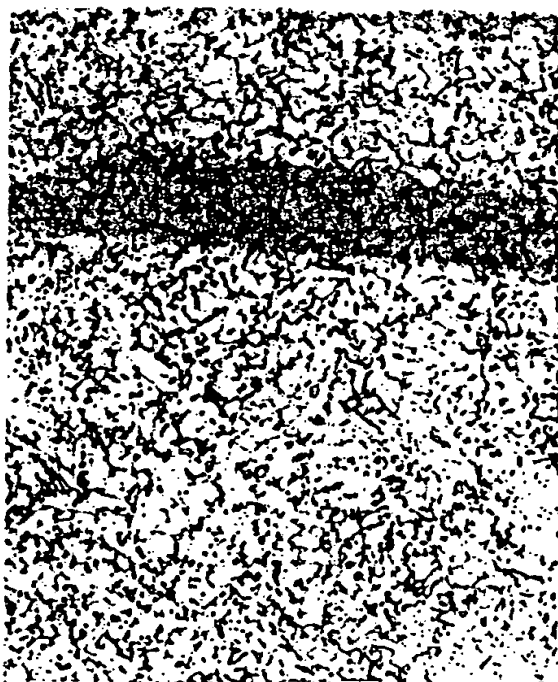


FIG. 22



AFTER SPHERODIZING ANNEALING PATTERN 2  
SURFACE LAYER  $\times 100$

FIG. 23



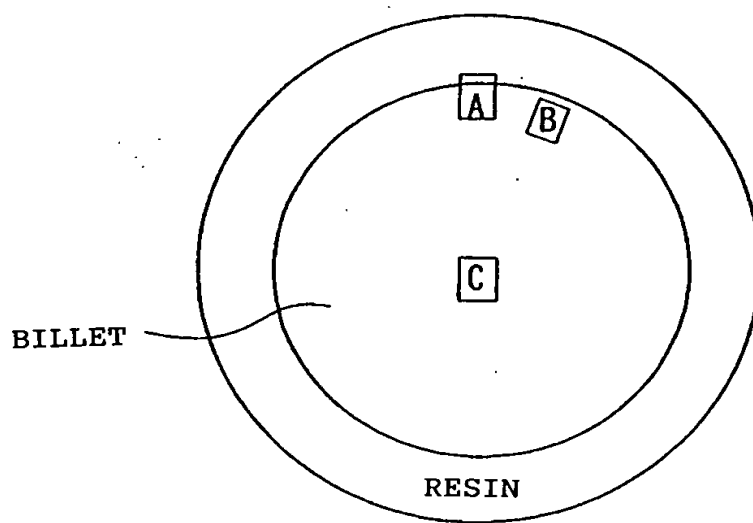
AFTER SPHERODIZING ANNEALING PATTERN 2  
SURFACE LAYER  $\times 400$

FIG. 21



MARTENSITIC MATERIAL  
AFTER SPHERODIZING ANNEALING PATTERN 2  
x 2. 1

(a)



(b)



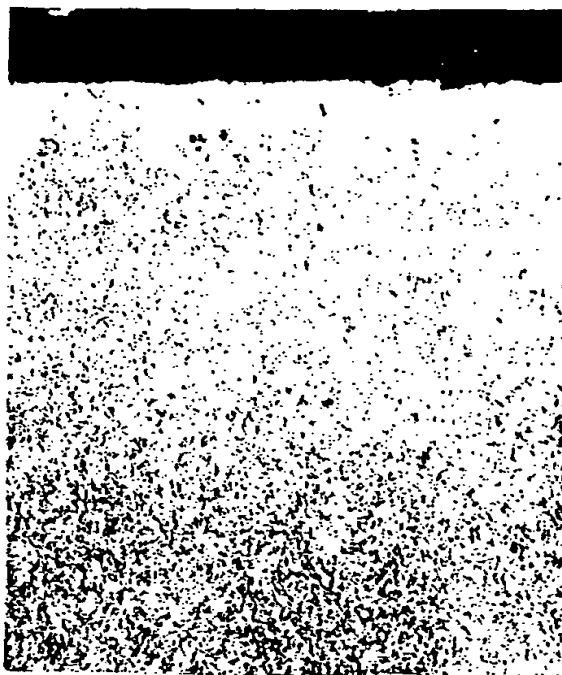
FIG. 20



AFTER SPHERODIZING ANNEALING PATTERN 1  
1/2 R PART  $\times 400$

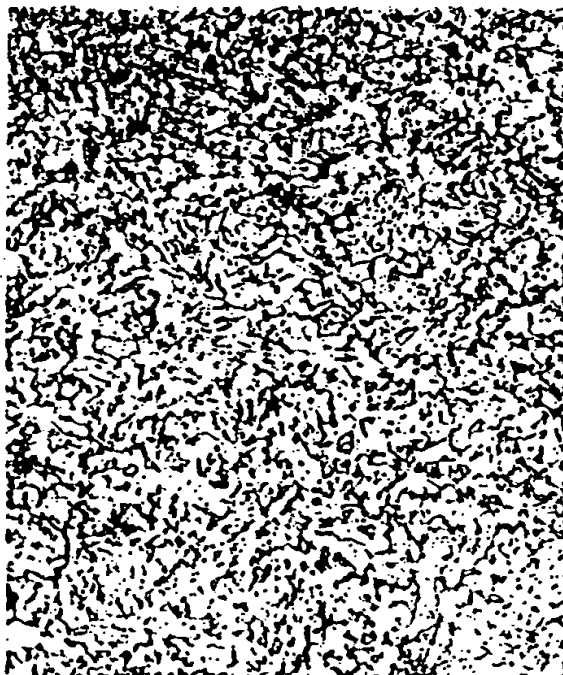


FIG. 18



AFTER SPHERODIZING ANNEALING PATTERN 1  
SURFACE LAYER  $\times 100$

FIG. 19



AFTER SPHERODIZING ANNEALING PATTERN 1  
SURFACE LAYER  $\times 400$

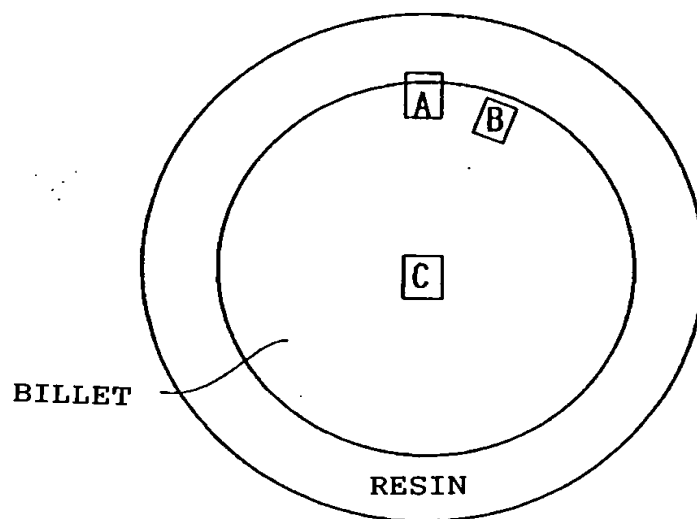


FIG. 17



MARTENSITIC MATERIAL  
AFTER SPHERODIZING ANNEALING PATTERN 1  
x 2. 1

(a)



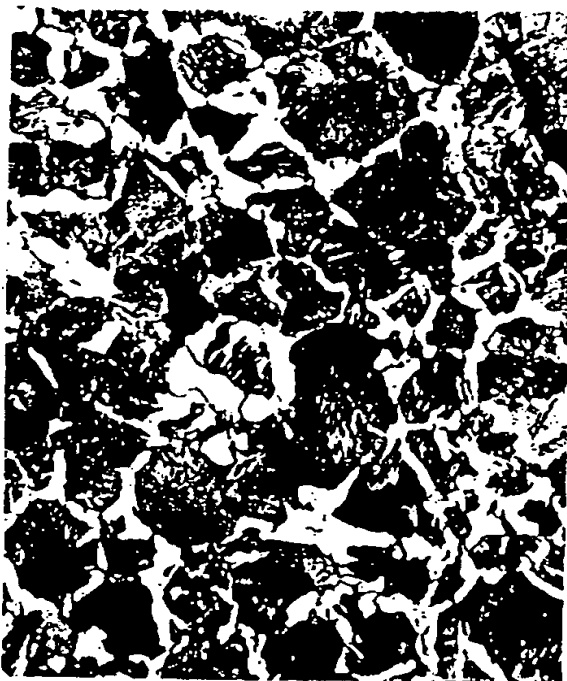
(b)

FIG. 15



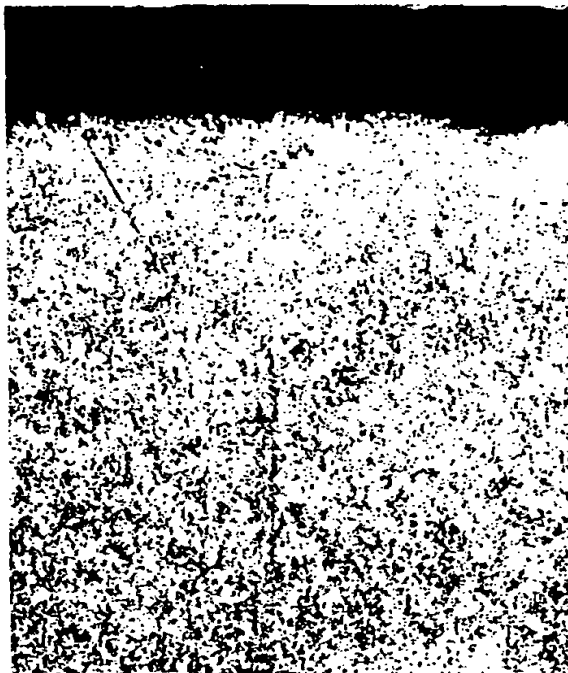
PRIOR TO SPHERODIZING ANNEALING  
1/2 R PART  $\times 400$

FIG. 16



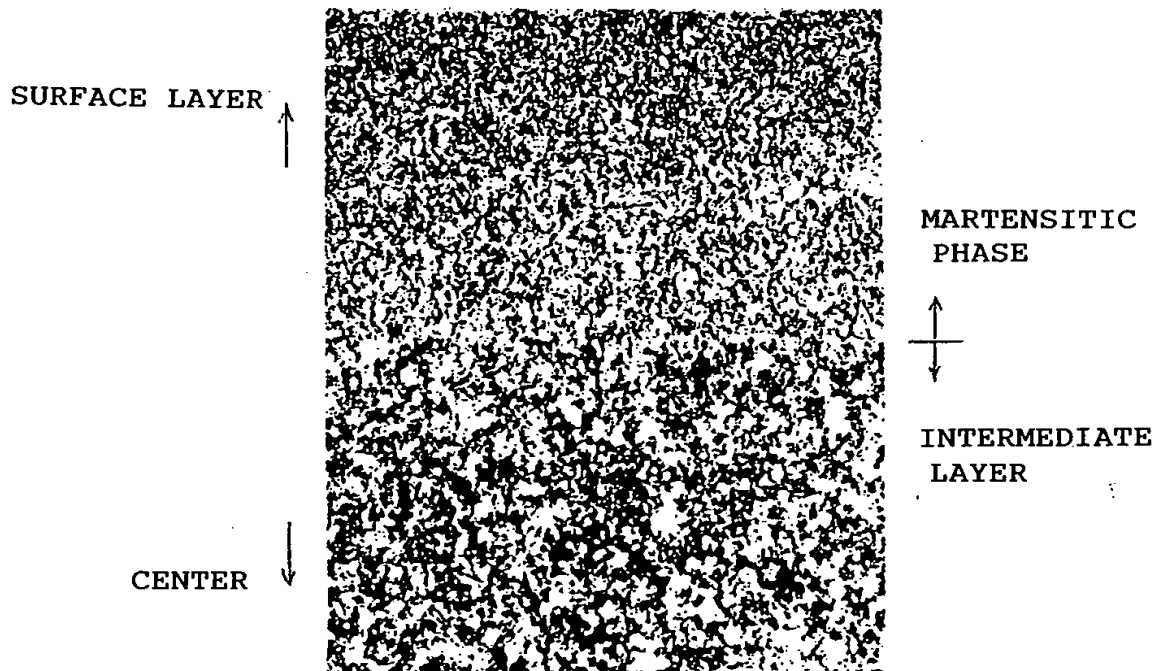
PRIOR TO SPHERODIZING ANNEALING  
CENTRAL PART  $\times 400$

FIG. 13



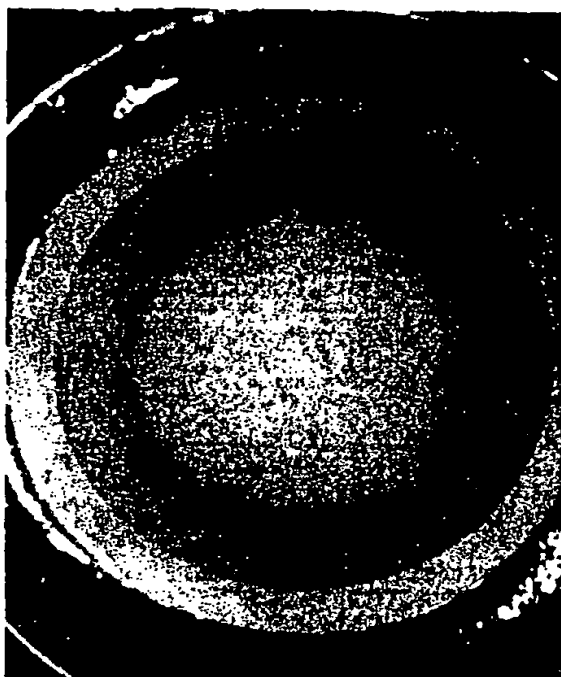
PRIOR TO SPHERODIZING ANNEALING  
SURFACE LAYER  $\times 100$

FIG. 14



PRIOR TO SPHERODIZING ANNEALING  
SURFACE LAYER AND INTERMEDIATE LAYER  $\times 200$

FIG. 12



MARTENSITIC MATERIAL  
(a) PRIOR TO SPHERODIZING ANNEALING  
× 2.1

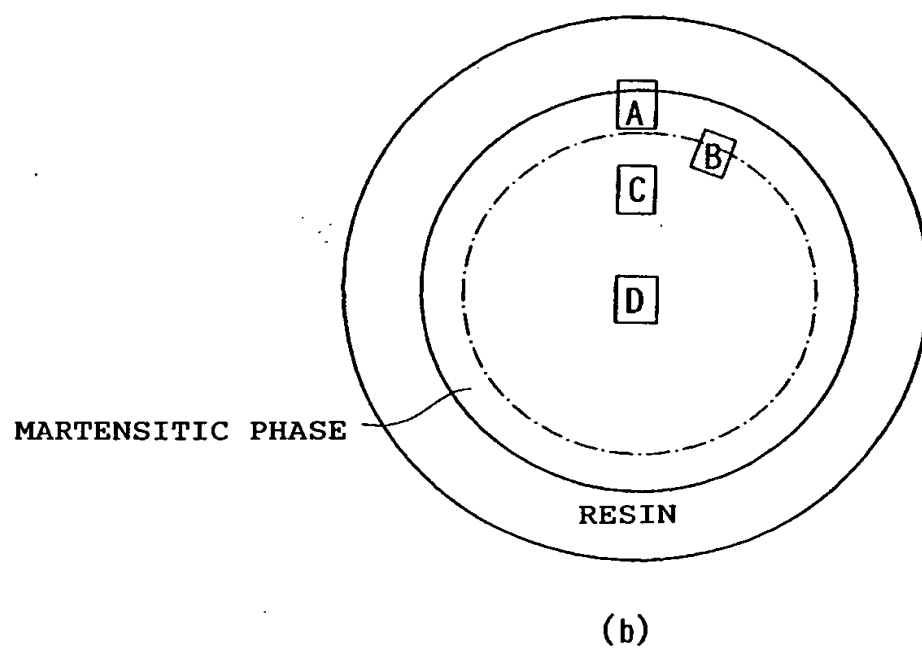
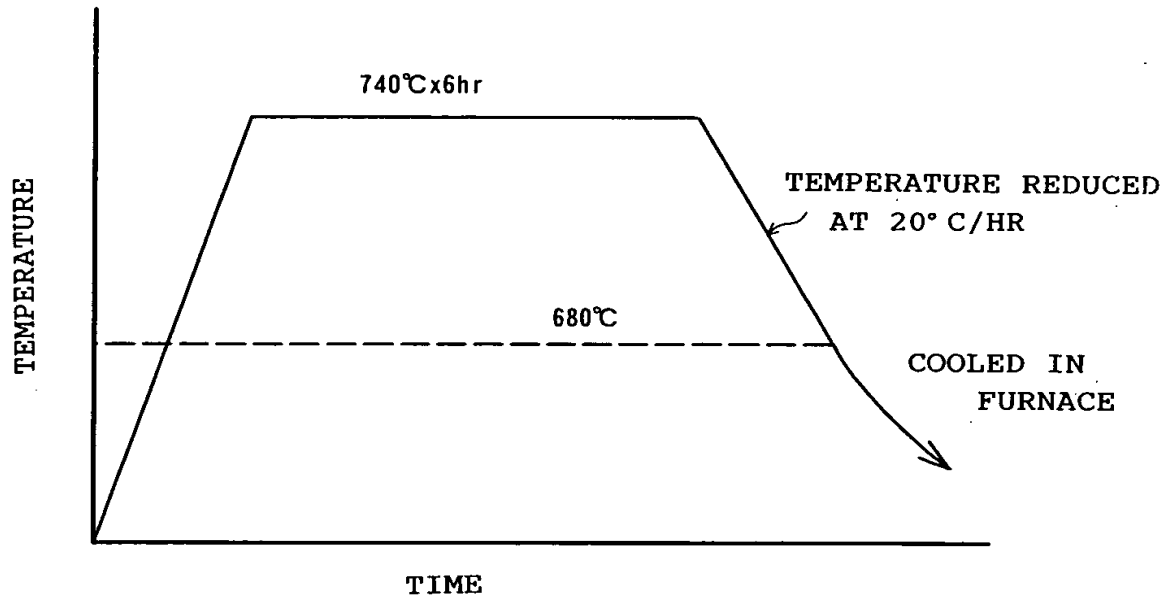
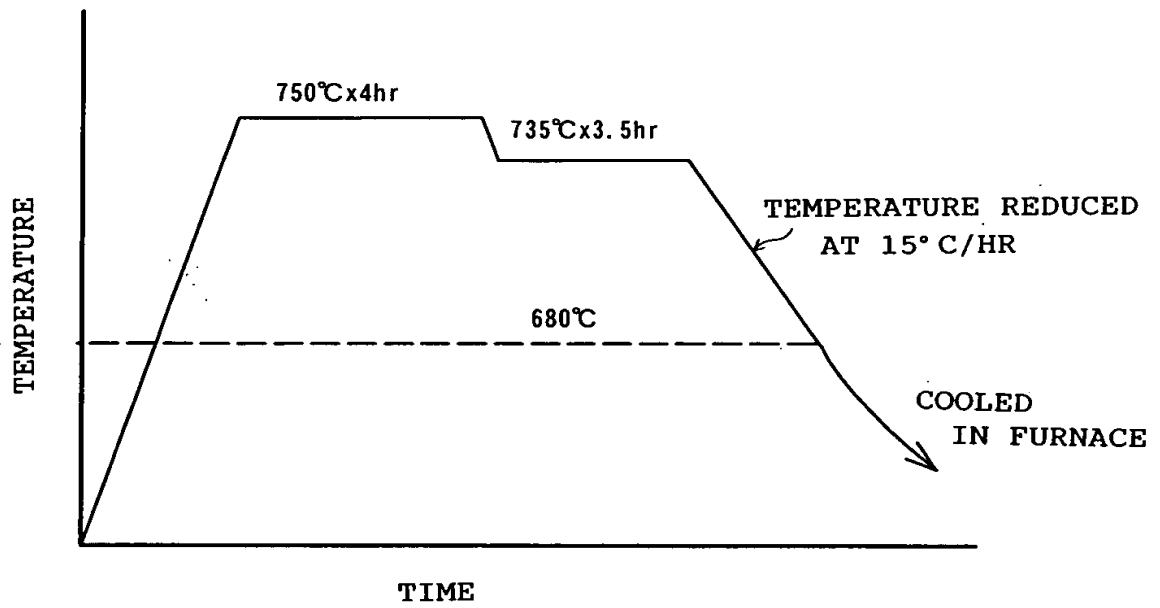


FIG. 11



(a)



(b)

FIG. 10

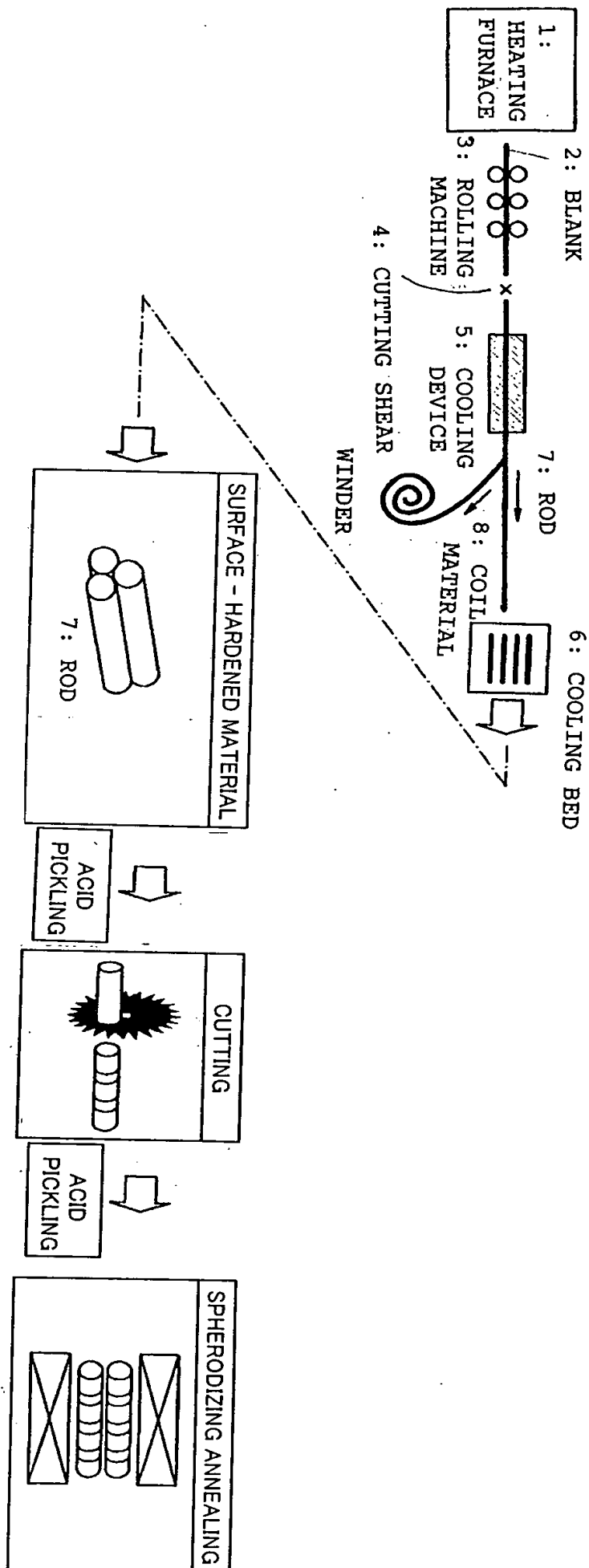




FIG. 9

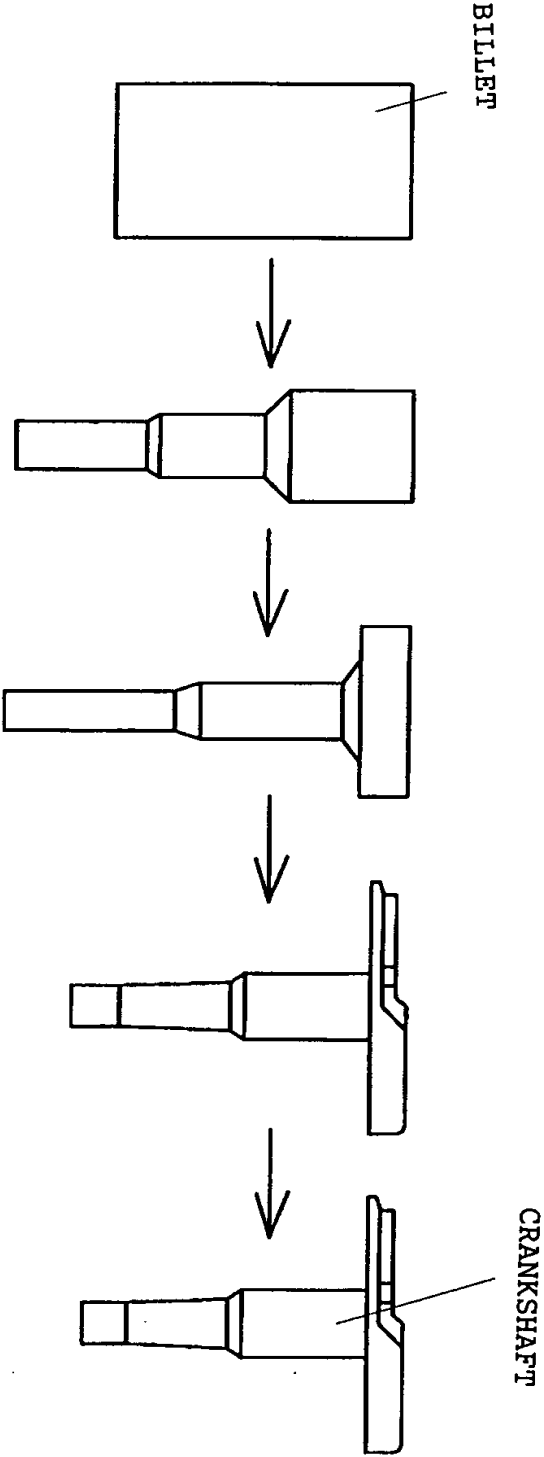


FIG. 8

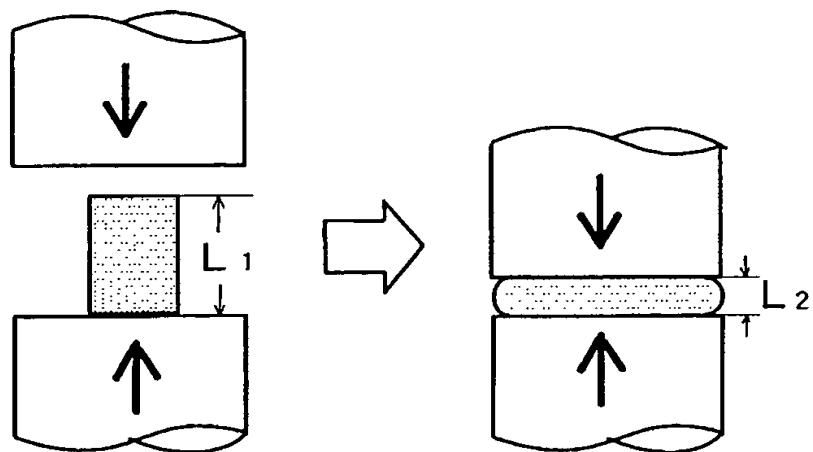


FIG. 7

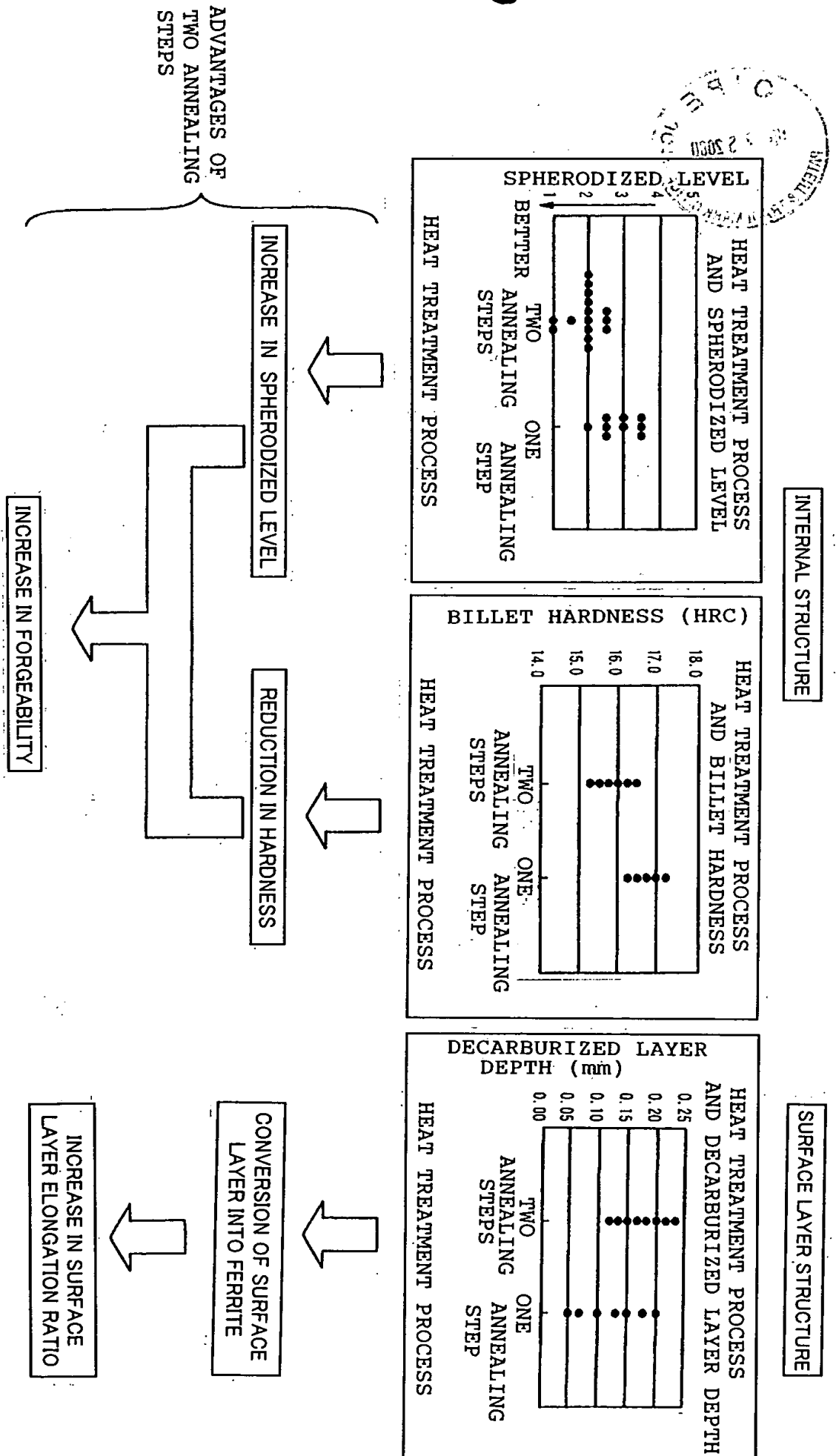


FIG. 6

(A) MATERIAL 1

ASPECT RATIO = 506 %



(B) MATERIAL 2

ASPECT RATIO = 347 %

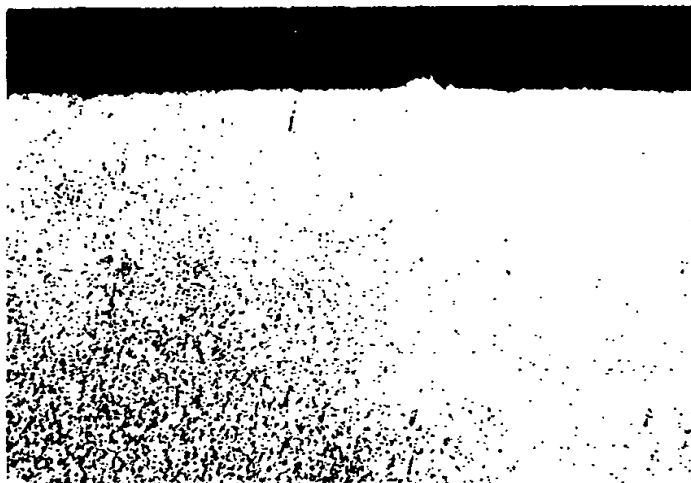


(C) MATERIAL 3

ASPECT RATIO = 300 %



FIG. 5

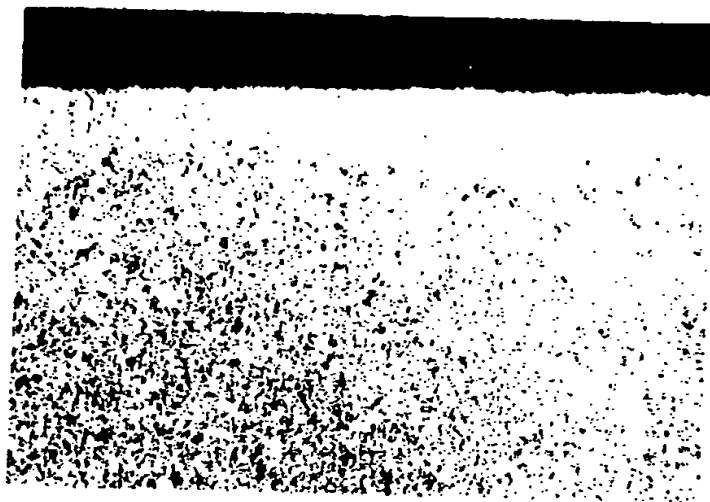


(a)

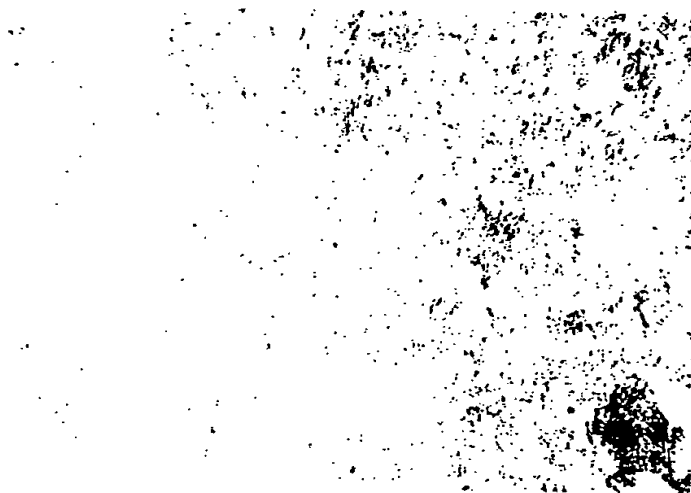


(b)

FIG. 4

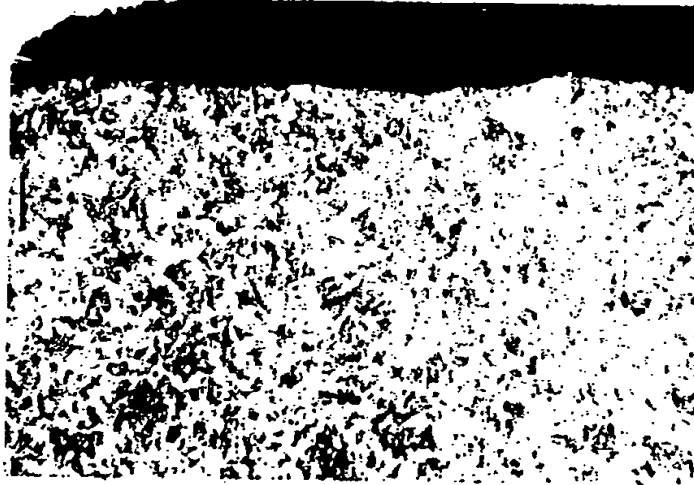


(a)

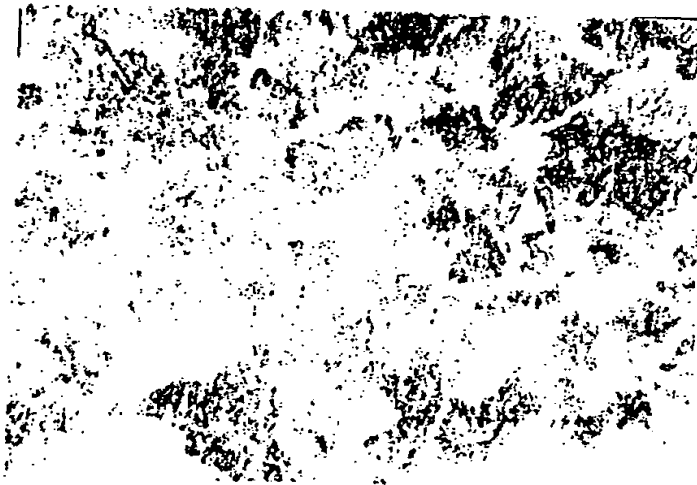


(b)

FIG. 3



(a)



(b)

FIG. 2

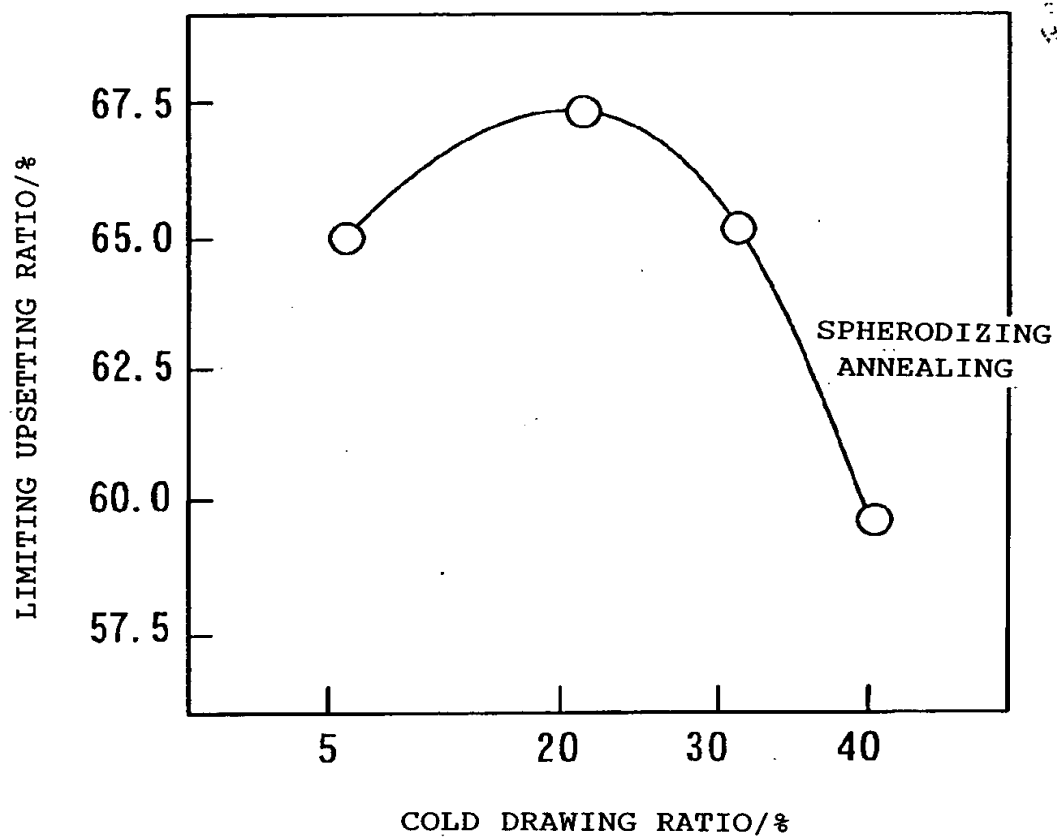




FIG. 1

